Technical Report Number
62-5

FINAL REPORT ON
REVIEW OF MEDICAL AND BIOLOGICAL PROGRAMS
WITHIN THE DEPARTMENT OF DEFENSE

AUGUST 1962

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Institute for Defense Analyses

Research and Engineering Support Division

TECHNICAL REPORT 62-5

FINAL REPORT ON

REVIEW OF MEDICAL AND BIOLOGICAL PROGRAMS

WITHIN THE DEPARTMENT OF DEFENSE

Submitted by:

Herbert Pollack, M.D.,
Chairman

Approved:

G.W. Brady, Assistant Director

August 1962

INSTITUTE FOR DEFENSE ANALYSES
RESEARCH AND ENGINEERING SUPPORT DIVISION

Contract SD-50
Task 20

August 1, 1962

Dr. Harold Brown
Director of Defense Research and Engineering
Office of The Secretary of Defense
Room 3E1006 - The Pentagon
Washington 25, D.C.

Dear Dr. Brown:

Task 20 Panel was convened at your request and held its first meetings on November 30, December 1-2, 1961. Appendix "R" lists the series of briefings presented to the Panel for their orientation. Project site visits were made to representative Service laboratories and a summary of the reports on the individual laboratories is to be found in Appendix "N."

An Interim Letter Report was presented to you, May 8, 1962. The Recommendations of the Interim Report appear in Appendix "S." The Recommendations of the Final Report differ somewhat from those of the Interim Report. Specifically, Recommendation 4 of Part IV in the Interim Report is now Number 6 of Part IV, and has been rephrased to simplify promulgation. The broad administrative recommendations of Part VI have been rewritten and new alternative suggestions have been made.

In accordance with the Memorandum from the Director of ARPA to the Director, IDA/RESD, dated July 6, 1962 (Appendix "T"), this Final Report does not include quantitative details as relate to funding or personnel. It does not include a detailed review of the contractual and grant programs or the overlap between the Defense program and programs of other government agencies.

Appendix "B" presents summaries of some of the reports which led to the reorganizations of the Department of Defense.

Appendix "C" is a summary of the administration of biomedical contract research in the Department of Defense.

The report deals most extensively with the Department of Army biomedical research because this is the largest program of the three Services. The Navy program is next in size and equally important. Little comment is made about the Air Force program which stems from the original stipulation given to the Panel that the bioastronautics program was under review and need

not concern the Task 20 Panel. Bioastronautics is the major part of the Air Force biomedical program and is under the jurisdiction of the Systems Command and not directly under the Surgeon General. Comments on the Air Force laboratories are included in the project site visits reports.

In general, the biomedical research program is divided into two categories: (1) that which is oriented directly toward improvement of patient care, and (2) that which deals primarily with long-range protection of people from a variety of hostile environments. The former is usually called clinical research and deals with a variety of subjects such as shock, trauma, improved surgical techniques, and medical therapeutics. The latter is focused primarily on a variety of physiological studies of the adaptative mechanisms of the body to a variety of stimuli ranging from thermal changes to noise. It can be stated parenthetically that in civilian laboratories the biochemical approach to both categories predominates today, as civilian interest is focused primarily on metabolic demands and requirements which are of primary interest at present in terms of the long-time well being of the organisms.

The Panel recognized that the most important objective of any research and development program of the military is future capability. This is especially true in the biomedical area since man is emerging as the most important unit of the future, not en masse and located according to the strategy of large numbers, but as specialized and expert units in a very complex pattern of co-ordinated activity. There is an obligation of the highest order for our military establishment to insure an active and farsighted program of research and development in the biomedical sciences so that man may be used most effectively.

An increasing responsibility of the Armed Forces medical services in the future will be to prepare medical corps and medical service officers for responsibility in newly developing areas of the world. In these areas, malnutrition, acute infections, parasitic diseases, and other environmental factors are primary hazards. Much research is needed to develop the skills to combat these problems.

The Panel wishes to extend its most sincere appreciation to the Office of the Surgeon General, Department of the Army, for their complete cooperation and unstinting help. The Commanding General of the R&D Command and his deputies, the staff at Walter

Reed Army Institute of Research, and above all, the Life Sciences staff in the Army Research Office were outstandingly helpful. The Navy also was more than cooperative. The Director of the Research Division, Bureau of Medicine and Surgery, Department of the Navy, gave a great deal of time and effort to make material available to the Panel. The promptness and completeness of his replies indicated his personal interest in this review.

The assigned project officers were of tremendous help in this Task. The Panel Chairman, in the absence of a full-time staff of his own, depended on them for support. It was largely their sympathetic understanding of the problems and unstinted giving of their time and energies that made the early completion of the report possible.

Respectfully submitted,

Herbert Pollack

Herbert Pollack, M.D.
Chairman Task 20 Panel

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TASK 20 PANEL MEMBERS

Dr. Herbert Pollack, IDA/RESD, Chairman

Dr. Alfred Blumstein, IDA/RESD

Dr. Thomas H. Carroll, President
The George Washington University

Dr. Eugene P. Cronkite
Head, Division of Experimental Pathology
Medical Research Center
Brookhaven National Laboratory

Dr. Gustave J. Dammin
Department of Pathology, Harvard Medical School
Armed Forces Epidemiological Board

Dr. Frank Fremont-Smith
American Institute of Biological Sciences

Dr. Wendell H. Griffith
University of California School of Medicine

Dr. Philip Handler
Chairman, Department of Biochemistry
Duke University Medical Center

Dr. James D. Hardy, Director
John Pierce Foundation, Yale University

Dr. Vincent J. Keenan, President
Philadelphia College of Pharmacy & Science

Dr. Earl W. Lindveit
American Council on Education

Dr. C.N.H. Long
Sterling Professor of Physiology
Yale University School of Medicine

TASK 20 PANEL MEMBERS--Continued

Dr. Richard P. Mason
Vice President for Research
The American Cancer Society, Inc.

General James McCormack, USAF (Ret.)
Vice President
Massachusetts Institute of Technology

Mr. Henry C. Meadow
School of Medicine, Harvard University

Mr. Richard M. Paget
Cresap, McCormick & Paget
New York City

Dr. H. Wallace Sinaiko, IDA/RESD

Dr. Joseph E. Smadel
Chief, Laboratory of Virology and Rickettsiology
National Institutes of Health

Dr. H. Burr Steinbach
Professor of Zoology
University of Chicago

Dr. William S. Stone, Dean
University of Maryland School of Medicine

Dr. W. Barry Wood, Jr.
Department of Microbiology
The Johns Hopkins University School of Medicine

Dr. John B. Youmans
United Health Foundations, Inc.
New York City

SUMMARY

I. Effective national defense demands a strong and comprehensive program in medicine and biology within the Defense establishment.

Existing chemical, bacteriological, and nuclear weapons can inflict destructive effects never before encountered. Extremes of man-made environments associated with advanced weapons systems can subject men to severe new physiological stresses. The effects of extremes of climatological and disease environments in the remote areas of the world must be understood and dealt with in order to maintain an effective mobile force. The success of future military operations may well depend on the ability to understand and deal with these problems through an adequate military biomedical program.

II. Serious deficiencies exist in present military biomedical research and development programs and establishments.

There are relatively few leaders and scientists of outstanding competence in the biomedical military establishment. The present organization of the military medical services makes the attraction and retention of such individuals difficult. This situation is aggravated by Civil Service regulations.

The limited talent available is diffused among scattered laboratories. Many of these are substantially out of communication with each other. This lack of communication leads to duplication

of effort. More difficult to rationalize is the neglect of many problems of obvious military importance.

III. <u>The development and maintenance of an adequate military medical and biological competence requires broad recognition of the need together with effective organization and leadership</u>.

Planned interaction between those responsible for policies, plans, weapons development and operations in the Defense Department and Armed Services and those responsible for the military biomedical programs is minimal at the present time.

There appears to be little understanding of, or enthusiasm for, the potential contributions of biology and medicine to the solution of military problems. Biology and medicine are not now represented in, nor have they direct access to, the higher levels of civilian or military planning or policy making. There are few if any individuals in a position to identify the overt or latent medical or biological problems inherent in present policy or plans and initiate action for their resolution. Such neglect seems inexcusable when the success of worldwide military operations is crucially dependent on medical and biological factors.

The Office of the Director of Defense Research and Engineering has the responsibility for approving the biomedical research and development programs. Without control of personnel or laboratory organization, research personnel responsible for key positions may be transferred out of the research and development laboratories without the knowledge of the Office of the Director of Defense Research and Engineering.

IV. Aspects of biomedical research which distinguish it from other research and development programs in the military establishment.

Conduct of the biomedical research program of the Department of Defense is subject to most of the difficulties of administration, organization, recruitment, budget, etc., common to R&D programs within the military establishment. In addition, there are difficulties which are sufficiently unique to the biomedical research program as to warrant its individual consideration and management.

(a) The Defense Department's non-biomedical research laboratories have a minimum of uniformed personnel with actual "bench" research responsibilities. In contrast, the uniformed personnel constitute more than 50% of the "bench" workers in the biomedical laboratories. This aggravates the rotation and obligatory service problems.

(b) The interdisciplinary nature of biomedical research makes it absolutely dependent upon the allied scientists (Medical Service Corps, Veterinary Corps, Dental Corps, and Nursing Corps). The newer technologies involved in biomedical research require training beyond that given the medical student in medical schools.

(c) In the Services, biomedical research is administratively separated in large part from development and application, i.e., clinical research and clinical care.

(d) Lack of representation at the planning level denies the Medical Departments early opportunities to develop research programs necessary to support the subsequent operations.

(e) The three major Services have different missions and operational requirements but all are dependent upon the utilization

of man. The primary function of the Medical Departments in each of the Services is to maintain the man. Thus the Medical Departments of the three Services have a common objective which transcends the unique requirements peculiar to each Service.

(f) The dollar value of a program as a measure of its importance is a very misleading index with respect to the biomedical program.

(g) The peacetime routine clinical responsibilities of the Service Medical Departments require the development of professional skills, i.e., obstetrics, gynecology, pediatrics, etc., that are not directly useful in the Medical Corps battle-support missions.

RECOMMENDATIONS

Part I The Necessity for Biomedical Research in Military Laboratories

1. The Panel strongly feels that the Department of Defense should continue and even expand support of its "in-house" research on biological and medical problems vital to military programs. In allocating funds and personnel, no distinction should be made between so-called basic and applied research.
2. High priority should be given to research programs which are clearly oriented to present or future military needs.

Part II Relationships of Operations to Research and Development

1. Serious attention should be given to increasing the contact between military personnel in operational planning and those with biomedical responsibilities. Clear channels of communication should be established between these two groups.
2. Relationship of Operations to R&D
   a. The Army Medical Service Combat Developments Group should be supported in its present activities aimed at improving military medical operations in the field.
   b. The Army Medical Service Combat Developments Group should be encouraged to expand its activities.

Similar groups should be formed to examine long-range operational plans for the purpose of identifying the medical problems inherent in these plans.

c. The Air Force and Navy should establish units with responsibilities similar to those stated in the two preceding paragraphs.

Part III. Analysis of Technical Programs

1. Important biomedical problems receiving insufficient attention exist in the present program:

a. Fatigue

b. Diarrheal and Dysenteric Diseases

c. Plans for Handling Mass Casualties

d. Radiation Biology

e. Shock and Trauma

f. Toxicological Studies

g. Physical Fitness and Selection Standards

h. Preconditioning of Personnel to Hostile Environments

i. Hepatitis and Viral Diseases

j. Dermatological Conditions

k. Neuropsychiatric Problems

l. Accidents

2. There are several programs from which the Panel believes the Department of Defense is not getting full value:

a. The Reactor at the Walter Reed Army Institute of Research - If an effective program cannot be develope

for this reactor, it should be dismounted. This is no longer to be considered a unique facility.

b. The current research activities at Ft. Knox should be transferred to more appropriate laboratories as soon as suitable space can be found.

c. In the field of protective clothing, an effort should be made to combine the duplicative efforts of the three Services.

d. It would seem logical to give one central laboratory responsibility to coordinate the basic research on certain physical environmental factors. Each Service could then apply itself to the developmental problems.

Clinical Research

e. Each of the large general hospitals in the Armed Forces with teaching responsibilities should have a Director of Clinical Research or Experimental Medicine to develop a program in this area and facilitate the development and utilization of research talent in terms of available clinical material.

Part IV Personnel for Military Biomedical Research

1. The number of scientist officers with research training assigned to biomedical research and development activities should be based upon the actual research and development needs independent of troop strength.

2. The command control of biomedical research installations of the military services should be assigned to uniformed officers with primary military occupational specialties in research and with recognized competence.
3. Civilian scientists should be given recognition and status equivalent or comparable to that given to uniformed personnel.
4. The assignment of all personnel with a primary military occupational specialty in research should be with the consent and advice of the Research and Development Command. There should be a promotion channel for research and development personnel based on accomplishment in this field.
5. It is recommended that the Secretary of Defense use the authority he now has to authorize specialist pay to selected officers and enlisted men. Particular attention should be given to the non-medical allied scientist officers with doctoral degrees.
6. Every effort should be made to set up an active, aggressive recruitment and training program for medical and non-medical scientist officers in the research and development program.

Part V Organization and Administration of Biomedical Research and Development

1. The annual biomedical research and development budget should be expended throughout the year in a manner conducive to the best support of research.

2. It is recommended that administrative control of research installations be returned to the R&D Command.

3. To correct duplication and inefficiency in the present biomedical research, full responsibility for all research in a given major area (e.g., infectious disease, trauma, radiation hazards, etc.) should be assigned where possible to a single designated laboratory. As an alternative vigorous steps should be taken to coordinate the efforts of the several laboratories which may work in the same area. Broad changes in program or level of activity should require prior approval in the Office of the Secretary of Defense on behalf of the three Services.

4. It is recommended that if recommendation 3 in this section cannot be carried out, outside agencies or universities should be assigned the management of those laboratories charged with the responsibility for crucial programs.

5. It is recommended that formal meetings of research and development personnel, particularly at the Division Chief level, should be held periodically. Adequate travel funds for this purpose should be provided.

6. Each of the Services should continue to operate one installation with a broadly defined mission. If unified or contractor-operated laboratories are established, this same principle should be applied. Only a laboratory with a broadly defined mission can respond rapidly to changing needs. Laboratories with broad missions, however, can be effective only if there is competent leadership.

Part VI Administrative Recommendations

1. A plan of organization, a statement of responsibilities, with recommendations as to how they can be discharged effectively should be developed and placed before the Secretary of Defense. Such a plan and statement should encompass the following:
   a. Centralization of responsibility for defining all biomedical clinical and research activities in one office within the Office of the Secretary of Defense. Provision should be made for adequate liaison with other divisions of the Secretary's office which have obligations in the field.
   b. Coordinating budgetary responsibility for all programs involving biomedical research and development, clinical care, manpower, and procurement.
2. Appointment of a departmental "Medical Biological Advisory Board," the Chairman of which should be the highest ranking civilian physician in the Office of the Secretary of Defense, and should include:
   a. Civilian representation from each of the Assistant Secretaries for Research and Development from each Service,
   b. A representative of the Joint Staff,

c. One officer of some seniority drawn from each of the Services who has demonstrated his ability in relating some field of technology to military developments, and

d. Six to eight outstanding civilian biological, medical, physical, and social scientists. These men must be competent in areas of particular interest to the military.

3. Establishment of contractor-managed biomedical research facilities under the Office of the Secretary of Defense as a way of overcoming personnel and administrative difficulties implicit in the present pattern of operations.

4. Provision and maintenance of liaison with the Joint Chiefs of Staff through the Joint Staff and with the individual Chiefs of Staff through the staffs of the individual Services.

Current Funding of Military Medical Research*

The current level of funding for medical research activities in the Department of Defense is indicated in the following table of apportionment requests:

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*For reference purposes the following funding statement is presented.

MILITARY MEDICAL RESEARCH APPORTIONMENT REQUESTS

FISCAL YEARS 1962 and 1963

(In Millions of Dollars)

	1962	1963
AIR FORCE		
Program Element No. 6.14.25.01.4 (Biosciences - Research)	2.140	2.012
Program Element No. 6.24.05.12.4 (Biological and Medical Sciences - Exploratory Development)	10.849	9.820
SUBTOTAL	12.989	11.832
ARMY		
Program Element No. 6.11.25.01.1 (Biological and Medical Sciences - Research)	34.314	44.275[1]
NAVY		
Program Element No. 6.12.25.01.2 (Biological and Medical Sciences - Research)	10.632	12.053
TOTAL	57.935	68.160

Source: Office of Medical Sciences, Office of Deputy Director of Defense Research and Engineering for Research and Information Systems.

Note: Army and Navy figures include salaries of in-house civilian scientific personnel and also laboratory support expenses (e.g., travel, overhead, equipment, etc.) Above totals do not include contingency funds for in-house laboratory independent research.

1/This figure includes only $32.6 million for AMEDS medical research; the remainder includes Quartermaster Corps programs on clothing, food and microbiology, and Chemical Corps medical programs on aspects of BW-CW protection.

INTRODUCTION

A strong biomedical program is vital to the mission of the Department of Defense.

Disease has always significantly affected the outcome of battle. During World War II and the Korean episode, the most serious and widespread diseases were dengue fever, scrub typhus, dysentery and diarrhea, cold injury, respiratory diseases, diphtheria, hepatitis, and malaria. These are not the diseases found in the United States but are predominant in those parts of the world currently or potentially involved in limited warfare. Physicians practicing medicine in this country are not as a rule prepared to cope with them.

Cause of Admission to Medical Treatment Facility

	Percentage of Admissions		
	Disease	Non-Battle Injury	Battle Wounds
World War II (European Theater)	63%	14%	23%
Korea	66%	17%	17%
Sues - 1956 (British)	76%	12%	12%

The crippling mortality rate from such disorders is, of itself, a serious military problem. The morbidity rate far exceeds the mortality rate and the long, slow convalescence with its consequent impairment of the combat capability may well render a military unit,

large or small, unfit for military purposes. Moreover, the drain on military resources, e.g., logistics and transportation to support such non-effective groups can seriously compromise military effectiveness.

Recent military history is replete with examples of the impact of disease casualties on fighting units. (See Appendix "A").

Even in recent operations, where no actual combat was involved, casualties due to medical causes alone have been extremely high. In Lebanon, at one time as many as 50% of the United States Forces were non-effective from diarrheal diseases. Unexpectedly large portions of the British Forces operating in Kuwait despite their long experiences in such environments were disabled by environmental conditions.

In the future, the military will have to continue to deal with these recurrent medical problems. In addition, many new problems arising from the changing nature of warfare will demand solution. Chemical, bacteriological, and nuclear weapons can inflict effects never before encountered. Extremes of man-made environments associated with advanced weapons systems will subject men to severe new physiological stresses. The effects of extremes of climatological and disease environments in the remote areas of the world must be controlled if we are to maintain an effective mobile force. The success of future military operations may well depend on an adequate military biomedical research program. Man, singly and in small numbers

as specialized and expert units in a complex pattern of activity coordinated with other men or part of the man-machine pattern may be the determinants in future wars.

Clinical investigation is vitally important and is severely circumscribed by two factors:

(1) It must be carried out on man.

(2) It must be conducted by physicians.

Because of legal, human, and professional considerations, a qualified physician must be in charge. The basic education of the military medical officer is in the hands of the civilian medical schools. This educational period is aimed at providing a basis for the practice of bedside medicine and does not prepare for a research career. It is totally inadequate without extensive further training for research workers, in general, and military medical research, in particular.

The training given to the specialists in the allied biological sciences is being narrowed. Such an individual undergoes very specialized training and actually participates in research techniques and procedures in the preparation of his thesis; in addition, three or four post-doctoral years of participation in research has now become a normal part of his training. The necessity for supporting the post graduate training of all scientists recruited into the Armed Forces is accepted. The biomedical scientist is no exception.

The shift from bedside physician to research or to military operational problems is rarely possible today without supplemental intensive

training in medical sciences, physics, chemistry, and mathematics. The modern clinical investigator and truely effective military medical officer must be both a competent physician and a well-trained scientist.

The dependence of military medical research on the allied sciences and allied scientists calls for a careful review of the provisions for post-graduate training of career military medical officers and the problems of the Medical Service Corps officers. (These are discussed in the body of the report.)

The military medical services have a dual role at all times. During peacetime they are continually pre-occupied with the daily medical care of the Armed Forces personnel and their dependents, and retired personnel and their dependents. As career personnel are retiring at an earlier age (a recruitment device), their wives are still in the child-bearing period and continue as a responsibility of military medicine. Thus, obstetrics, gynecology, and pediatrics, three medical specialties far removed from military medicine, are fast becoming major utilizers of professional personnel. This trend is contrary to the demands we know will be made in war-time. In World War II after Pearl Harbor there were practically no career medical officers available for assignment to clinical and direct patient care duties.

The major function of the medical departments in time of peace should be to prepare for effective participation in future wars. They must develop research programs based upon the need to develop new information to support the military defensive and offensive operations with

the new weapons and tactics, and in the locale dictated by circumstances or chosen by the military planners. The requirements of the daily problems of hospital administration, personnel recruitment, and care of the sick and other routine responsibilities limit the number of people available for the research programs. For instance, in the Army, out of 4,000 Medical Service Corps officers only 180 are allocated to research and in the Navy out of 1,346, only 100 are so assigned. With respect to medical officers, similarly the number assigned to R&D is indeed limited.

The military aspects of medicine present unique problems. It is the duty of the medical military people to devote time and attention to them. The Army is to be commended on its recent move to increase the post-graduate training support for officers assigned to research. What is needed is that the medical departments develop a branch specializing in biomedical aspects of military operational problems. The training in clinical specialties of civilian importance can be carried out in civilian institutions.

In the area known as molecular biology, distinctions between physics, chemistry, and biology, have largely disappeared. Hopefully this is an inevitable trend toward the ultimate dissolution of disciplinary barriers between biology and the physical sciences.

However, the subject matter of molecular biology presents a special situation at this time. Leaving this level and going into the complex systems, such as those involved in physiology or clinical medicine, it

becomes apparent that molecular biology can at best provide only a basic vocabulary for the future. Complex total biological systems, while needing the contributions which the physical sciences can give, are biomedical problems, and they must be met by men competently trained in the biological sciences. The physicist and engineer, if he attempts to apply his techniques directly to these problems without reference to the total structure of the organism, will miss the mark.

The failure of engineers to recognize the above fact--that biomedical problems, even when they require sophisticated instrumentation, are still biomedical--is one of the grave road blocks in the partnership between engineering and medicine today. This communications failure is obstructing real team work and progress between the two sciences.

For example: Medical diagnosis is at present not simply the assembling of data leading to a specific action by the physician. The medical problem, to a large extent, is based on many indirect types of evidence that cannot as yet be programmed into a computer. While efforts must continue to be made to properly define parameters entering into a clinical diagnosis, premature attempts to apply such programming to patient care can lead to unfortunate results.

PART I

I. The Necessity for Biomedical Research in Military Laboratories

The Panel strongly feels that the Department of Defense should continue and expand support of its "in-house" research effort into the biological and medical problems vital to military programs, and make every effort to increase the effectiveness of its present program and installations.

The need for biomedical research and development facilities within the military establishment is based on these factors:

1. The necessity for familiarizing military personnel with medical and biological problems relating to all phases of national defense. This is essential to insure that we will have a sufficient supply of officers, with the necessary know-how in these problems, who later will serve in command and policy-making posts.
2. The importance of developing individuals who are alert to the specific demands of military problems for the planning and supervision of biomedical research.
3. The necessity for security control in selected areas of research and development.
4. The need for certain facilities which can function satisfactorily only under military control.

It is imperative to recognize at all times that there are problems involving the biology of man which may seriously limit the ability of the military to accomplish its missions.

Problems without precedent in medicine and biology constantly are presented by the development of new weapons and the evolution of new conditions of warfare. It is plain that these problems can be solved only by a capable military research and development establishment.

If war comes tomorrow, we must expect to deal with weapons of mass destruction. The machinery for their effective delivery is in existence. They may be used even in the special situations of limited warfare today. Thus, manpower becomes potentially the most critical and important continuing factor in our national defense. All military commanders, therefore, should be indoctrinated thoroughly in the biomedical factors necessary to conserve manpower. They also must recognize the importance of research as a means of preventing manpower losses, both civil and military.

Today, all of the sciences are advancing rapidly. The various branches do not stand alone and in isolation; they go hand-in-hand, adding up to an over-all pool of knowledge. Obviously, it is of prime importance that the Office of the Secretary of Defense should be in position to take full and immediate advantage of scientific developments. This can be accomplished in part through association with universities and with other civilian research organizations. It must come primarily in connection with urgent military problems, however, from facilities

under control of the Department of Defense. This applies to biomedical research as well as to research in other areas.

In seeking a way to approach the problem, the recent remarks of Dr. Keith Cannon of the National Research Council, speaking to the Armed Forces Epidemiological Board, are pertinent:

> "The major responsibility for the support of medical research in the nation lies with the National Institutes of Health. Its deliberate policy is to extend support to proposals spontaneously submitted by investigators and so it is neither in a position to, nor does it attempt to organize programs directed toward the solution of specific problems of operating agencies. Such problems only can be visualized investigatively, and attacked by the particular agency whose mission is challenged by the problem concerned."

The military cannot wait for civilian research to get around to finding the answers which a military situation demands right now. The present pace must be accelerated. Crash programs, hastily developed after the trouble starts, are not the answer. They are costly, and results are not always ready when needed.

The situation must be viewed pessimistically but realistically on the basis that any day the cold war may turn hot. We must take advantage of the time remaining to seek out the best protection possible against those factors of disease or stress which can sap our military potential. In the past, the United States has had the edge over its opponents in manpower and resources. Against the Soviet bloc, it is questionable whether we can afford to overlook any possibilities when it comes to protecting and conserving our manpower.

In general, the military establishment should not engage extensively in research whose goals appear to have no direct relation to the military missions. (See Appendix "P") However, basic problems often arise during the course of "mission-oriented" research. Under such circumstances, there should be sufficient flexibility to permit agencies to initiate this type of research. Also, such research should be stimulated through grants and mutual assistance between military and civilian research groups where this appears profitable. An excellent example is the respiratory disease study at Camp Lejeune, in cooperation with the National Institutes of Health.

If, however, there is neither interest nor competence in university or other civilian laboratories, or if the urgency of a problem requires more immediate action than is possible in these laboratories, the military establishment should undertake the research.

Often, in planning and carrying out important military medical research projects, it is necessary to procure or construct unusual or costly equipment or facilities. In such cases, it is recommended that they be housed or built near a university with a faculty that is strong in the particular field of research under study. This policy can result in mutual benefit to both the military and the university.

The Panel recommends that high priority be given to research programs which are clearly oriented to military needs.

Careful study of the actual progress of almost any significant research program will show that the basic and applied aspects are

inextricably interwoven. All basic research requires the use of previously developed knowledge, techniques, and concepts; to that extent, it may be considered "applied." Furthermore, basic research findings may have unexpected and direct application to practical problems. Flemming's accidental discovery of the antibiotic qualities of penicillin is a case in point.

The effort to protect man against conditions of extreme cold is another example. To solve this critical problem, it may be necessary to study control of the circulation of blood through the skin, or the role of the brain as a "thermometer" for the body. Such studies well might be considered "basic" research. Yet, they also are clearly "applied" research in that they are part of the effort to find the answer to a specific problem.

From the foregoing, it is clear that no sharp line can be drawn between "basic" and "applied" research. Any attempt to enforce an arbitrary division between these two areas is utterly unrealistic.

In the light of the above, the Department of Defense, or any of the three military branches, should base decisions on the allocation of funds to costly and time-consuming research projects on (1) military needs, as established by (2) competent scientific judgment. These decisions should be supported by adequate representation and authority on policy-making levels.

PART II

II. Relationship of Operations to Research and Development

1. Serious attention should be given to increasing contact between military personnel in operational planning and those with biomedical responsibilities. Clear channels of communication should be established between these two groups.

All research and development in the Department of Defense should be oriented to the improvement of the operational capability of the Armed Forces. There is a vast backlog of problems to be solved, and the urgency to solve them is great. Therefore, in assigning priorities to military biomedical research, the luxury of shooting in the dark in the hope of hitting on something of value must be put aside. The target must be the immediate needs of the Armed Forces.

The new warfare--bacteriological, chemical, nuclear--is aimed not against tanks and planes but against the individual soldier. This emphasizes the importance of the Medical Department. It also increases the need for biomedical research to solve the problems that will arise from these new factors. As solutions are found, they must be put to use immediately in military plans and operations.

Studies of future operations must develop certain clear indications of needs, and these needs should be the goal for research. The range of possible military situations--from large counter-guerrilla operations

in exotic environments such as Southeast Asia to treatment of mass casualties in a thermonuclear attack--is far greater than ever has been contemplated in military medicine. Medical research and development personnel must become familiar with these possibilities and with the medical problems associated with each situation.

At present, the military Medical Departments are chiefly occupied with maintaining the health and curing illnesses of military personnel and their dependents. In peacetime, current medical knowledge is used in essentially standard or normal non-military locales. This situation is in contrast with the usual conditions pertaining to peacetime responsibilities of many line officers and weapons systems designers. Their efforts are devoted almost exclusively to preparing for future warfare. Their planning traditionally involves new concepts developed by weapons research.

At its initial briefing sessions, the Panel was told by the Plans and Operations Officer of the Office of the Surgeon General, Department of Army (See Appendix "O"):

> "Often the staff agency taking actions with medical operational implications is too far away in the chain of command to be fully cognizant of the medical aspects of their decisions. Medical planning activities would be more effective and the Army General Staff more responsive if the medical department were not under the command of a single general staff section, but had direct access to all staff sections and the Chief of Staff."

At present, many line officers are not adequately aware of the potential military benefits to be gained from the applications of biomedical knowledge. There is too little incentive for these officers to identify biomedical problems and to ask for assistance, which could include research and development efforts.

On the other hand, biomedically trained personnel are shut out almost entirely from the larger planning process. This situation results partly from their unfamiliarity with operational problems, and partly from planners' failure to appreciate the potential contributions of biomedical research.

In the area of advanced conceptual planning, including matters relating to budget-making, requirements for total military construction programs, and programming of broad research areas--no coordinating mechanism exists within the three Services. There are more similarities than differences among the three Services in the biomedical field. Consequently, the lack of coordination is particularly noticeable here.

The Army Medical Service Combat Developments Group, located at Brooke Army Medical Center, Fort Sam Houston, Texas, is of particular interest in medical planning and operations. It is funded by the Office of the Surgeon General, of which it is part. The Group supports the Research and Development Command, particularly in medical field service areas, and its contract studies are largely financed by R&D funds.

The Panel has studied the AMSDG, and has these specific recommendations:

1. The Group should be supported in its present activities aimed at improving medical operations in the military field.
2. The Group should be encouraged to expand its activities. Also, other similar groups should be formed to examine long-range operational plans for the purpose of identifying the medical problems inherent in these plans.
3. The Air Force and Navy should establish units comparable in function to those described in the two preceding paragraphs.

The present Combat Developments program can be grouped into several general categories. The highest priority goes to casualty assessment studies. These studies are to determine the effect of nuclear, biological, and chemical weapons, as well as improved conventional weapons, on the medical work-load. The studies include an appraisal of the effects of all types of weapons when used together.

The Group also conducts organizational studies, designed to produce plans for medical support of the long-range Army.

In such projects, communications between personnel involved is a basic problem. It can be solved only by increasing the understanding and contact between the worlds of military operations and biomedical research.

Able and responsible individuals must be found to:

1. Examine the long-range operational plans and identify the inherent medical problems.
2. Assist in assignment of research and development tasks so as to achieve maximum effectiveness in solving military medical problems.
3. Conduct and apply the results of research with the aim of improving medical operations in the military field.

Research and development and operations interrelationships would be greatly enhanced by assigning a carefully selected biomedical R&D man to operational planning staffs. This would stimulate awareness of the operational problems to which research must be directed. At the same time, it would enable military planners to become more conscious of the results of the biomedical research programs. (It should be noted that the Alvarez report came to a similar conclusion.)

Research and development personnel must be encouraged to convert existing or developing policy or plans into the kind of action that will lead to identification of biomedical problems. Training along these lines should be pushed vigorously. The goal is to achieve the utmost practical application of existing knowledge, and to launch appropriate research to fill in the gaps where existing knowledge fails to meet the needs.

PART III

III. Analysis of Technical Programs

1. Gaps in the Present Program

After reviewing the biomedical research programs within the Department of Defense, the Panel believes there are serious gaps. These include vital areas which either are not supported adequately or are not under current investigation.

The five-year plan of the Army Medical Service and some of the Navy's programs recognize the need for increased effort in many of the areas listed below. To a large extent, the problem has been lack of budget and personnel, rather than failure of the Services to appreciate the importance of the problem. The Panel strongly urges increased support to encourage the recruiting of scientists. Then, as competence is increased, funds should be made available to extend the work in the following areas where the gaps occur.

(a) Fatigue

The problem of fatigue, a serious one, is common to all three Services. It differs only in the circumstances under which the fatigue occurs. Establishment of some type of inter-Service fatigue laboratory or institute would be a desirable addition to the roster of existing laboratories.

The Panel has failed to find an organized long-range program to study the fatigue problem. At present, there is little civilian effort in this area. Since this is a subject of major

military importance, the responsibility must fall upon the Armed Services. It is recognized that the psychological problems of fatigue are extraordinarily difficult. Also, the biochemical and physiological problems have not attracted much attention recently.

Fatigue is made up of a complex group of physiological events. Fatigue is a result not only of the physical effort involved in a situation but of its accompanying emotional tensions--fear, and the purposeful disregard of the possible dire consequences to one's own person. The interest of all three Services in this problem is obvious. The success of a military effort is frequently governed by the ability of the personnel conducting an operation either to prevent, endure, or relieve fatigue.

Fatigue can be categorized into three broad areas. First is the fatigue which follows maximum muscular effort. This has a large circulatory component, in that it puts stress on the circulatory system. Second is the fatigue which comes from long periods of physical work even without maximum effort. Third is the fatigue, or tiredness, or sleepiness, which is associated with boredom, fear, anxiety, and the unconscious attempt to escape from an unpleasant situation. (See Appendices "J" and "Q").

The military must plan its operations within the limits of man's capacity to endure. Thus, it is essential to reach a better understanding than now is available of the physiological basis of fatigue. We also must know more about the possible pathological

consequences of prolonged exposure to fatigue-causing conditions. Such an understanding would enable military planners to devise means to sustain men in arduous circumstances for longer periods of time. It would bring about better restorative measures for those whose limits of endurance have been so far exceeded that they have become literally bloodless casualties of battle.

At present, none of the Services is pursuing any concentrated and continuing study of the problems of fatigue. Scattered programs which are related to this subject do exist. Minard is working on heat stress at the Naval Medical Research Institute (NMRI). The Arctic Aeromedical Laboratory is studying the effect of cold and starvation in producing fatigue. The Naval Medical Research Laboratory at New London and others are studying the relation of sensory deprivation to stress and fatigue. In addition, at Fort Knox there is a small program that deals with the type of fatigue associated with the handling of certain mechanical controls. The Air Force has a program which is limited to the specific problems of flying personnel. Full comprehension of the nature of the problem requires general physiological and biochemical research, including a complete examination of the nervous system's responses to the conditions associated with the development of fatigue.

(b) Diarrheal and Dysenteric Diseases

The possibility of future military actions in the Middle East, the Far East, and other tropical areas makes it necessary that we continue to rank dysentery as one of our major military medical problems. Its prevention and control will require a combination of discipline, hygiene, and advances in active immunology. Newer therapeutic agents are needed to control the sickness and limit the death rate among those who do contract one of the diarrheal diseases. Much excellent work has been done in the past along these lines, particularly by the Army and the Navy. However, we also must face the fact that solution of this major problem is a long way off.

In World War II, amoebic and bacillary dysentery cost us dearly. In the China-Burma-India Theater, the incidence of amebiasis in 1945 in one unit, the 305th Air Service Group, was 33.9 percent of the Command.

In the Pacific Theater, the effect of bacillary dysentery on our military operations can be summed up in one word--disaster. For instance, in the struggle to hold off the Japanese invaders in the Philippines, bacillary dysentery was by far the major factor in the ultimate collapse of the United States resistance. By April 3, 1942, more than half of the 31st Infantry Regiment, composed entirely of U.S. troops, succumbed either to malaria or dysentery.

Even in recent situations in which no actual combat was involved, casualties from diarrheal diseases have been extremely high. In Lebanon, at one time, as high as 50 percent of the United States Forces was non-effective due to diarrheal diseases.* In Kuwait, large portions of the British Forces were disabled by environmental conditions compounded by diarrheal diseases.**

The Department of the Army Office of the Surgeon General Research and Development Command is fully cognizant of this problem. In concept, the investigative program at the Walter Reed Army Institute of Research is excellent. It shows an understanding of the problem and ability to analyze the requirements. The results, however, leave much to be desired because of unfavorable personnel problems and some difficulties in funding. (See Appendix "L").

The Department of the Navy approach also is excellent. The Navy's foresight in developing Naval Medical Research Units (NAMRU) II and III many years ago now is showing results.

(c) Plans for Handling Mass Casualties

In the event of war, we must expect tactical use of nuclear weapons against troop concentrations in staging areas or in the field. The number of casualties from such attacks would overwhelm any existing

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*Details classified. Reports on file with OSG, Dept. of Army

**Secret report. Available OSG, Dept. of Army

military medical organization. It has been estimated that a nuclear attack on the United States, against military objectives alone, would cost the lives of 45 million Americans. (See Appendix "I").

Nowhere in the United States has the Panel found evidence of a realistic program of study for the handling of mass casualties. The Panel firmly believes such a study, involving medical research and advance planning, would do much to reduce the grim effects of such a possible military catastrophe.

Based on the unrealistic assumption of 100 percent survival of medical personnel (about 275,000) and the realistic assumption of 50 million persons dead or injured, the ratio is about 190 casualties to one medical service officer. The actual situation, of course, would be worse. Medical officers, nurses, corpsmen would constitute a proportion of the casualties. Medical facilities would be destroyed.

Thus, research in the handling of mass casualties must include development of mechanisms for self-help. The unsophisticated, untrained potential victim must be taught how to care for himself, his family, and others.

(d) Radiation Biology

Radiation biology is properly a subject for extensive study. The Army Medical Department has reactivated a program of chemical prophylaxis against radiation injury. This program had been initiated in 1948-50 by the U.S. Atomic Energy Commission and the Naval Medical Research Institute.

Progress has been made in understanding the mechanisms of the actions of protective chemical agents against radiation. There also has been some gain in reducing the inherent toxic effects of these chemicals on the human system. But a great need for continuing basic studies still exists. One thing that stands out as result of the tests that have been conducted is: the possible side effects of these drugs are so great that, in all probability, human beings will not be able to function effectively while using the drugs. This--as it now stands--will cut down on the maximum benefits man might otherwise obtain from these agents. If we can solve the problem of side effects, man may be able to almost double his tolerance for radiation.

Lack of an adequate study of the acute and chronic effects of long-term administration of anti-radiation drugs is a great handicap--as well as a serious defect in research planning.

There are also many troublesome--and intensely human--problems associated with the question of how to deal with nuclear disaster. One is: How will the overworked medical command deal with the problem of selecting the victims who are to be given treatment? Lacking sufficient medical manpower and capabilities to care for all, who is to say who is to be helped, and who is not to be helped? Obviously, the guiding principles must be selection of those who are given the best chance to survive, and who are most needed for the national good in the resistance to the enemy and in rebuilding the country. But what are to be the rules for selection? Research can contribute much toward finding the answers.

The Panel found that the new Office of Civil Defense within the Department of Defense is beginning to develop research programs in these areas. But no coordination with existing programs was noted. Communication between the Civil Defense research office and the Armed Forces is spotty. The Panel discovered there were offices in the Department of Defense that did not know what the Civil Defense group was doing, and vice versa.

(e) Shock and Trauma

The importance of developing a sound therapeutic approach in treating severely traumatized individuals who are in shock is obvious to those who have had the responsibility for their medical care. In the past, this goal was pursued actively. Lately, however, due to failure to achieve a major breakthrough, the pace of this research has declined. The need is still with us.

This report already has mentioned the importance of an adequate manpower supply in an age which might see a war involving weapons of mass destruction. The two most recent "old-style" wars--Korea and World War II--cost the United States 325,000 in battle dead, and 775,000 in battle-wounded.

The problem of treating trauma is equally vital to the civilian population. Among civilians, trauma--injuries, wounds, and shock--is the leading cause of death in the age group 1 to 24 years, and the second most frequent cause of death in the 22 to 44 age group.

The National Safety Foundation reports that, in 1960, there were 93,000 accidental deaths and more than 9 million non-fatal injuries. Among the population in general, accidents are the fourth major cause of all deaths.

Part of the mission of the Armed Forces has been to inflict injury on enemy troops. Obviously, the Armed Forces have had to expect injury in return. Traditionally, the injuries were directed toward troops. Then the World War II bombing and fire raids added civilian injuries as components of equal magnitude. Introduction of the civilian element also broadened the range of ages of patients and the types of injuries to be expected in warfare.

The Japanese experiences at Nagasaki and Hiroshima further demonstrated the overwhelming geographic concentration of casualties, and the total inadequacies of existing medical services. Continued changes in weaponry have made possible wars in which our nation may survive only if it is prepared for survival as well as retaliation. This places on the Department of Defense a clear responsibility to provide scientific and professional leadership in the management of military casualties resulting from military action. In addition, since the Department has the experience with the effects of nuclear bombs, it must share with the U.S. Public Health Service the ultimate responsibility for the management of civilian thermonuclear casualties. (See Appendix "K").

Meeting these responsibilities will not be easy. It calls for painstaking planning.

The current planning and activities of the Medical Departments of the Armed Forces are dominated by routine day-to-day health care of dependents and troops. The Armed Forces' requirements in major combat for professional medical personnel and their efficient use have not been worked out realistically. Only limited studies have been made of conditions as they would apply to the health and care of troops in the event of a war employing weapons of mass destruction. Carefully prepared plans do not exist for the handling of mass casualties.

There is no up-to-date evaluation of medical techniques for handling emergencies such as thermal burn casualties, large numbers of patients in shock, communicable disease control in disaster areas, radiation injury, or large numbers of casualties due to psychological trauma.

There is little appreciation of these deficiencies in our national planning. The Panel found no evidence that adequate action is being taken to improve the situation.

(f) Toxicological Studies

The large and continuing research and development effort in new rocket propellants has not evoked a program of comparable scope to probe the toxicity of these new chemicals. Traditionally, the propellant ingredient, e.g., hydrazine, borons, etc., has been close to

operational status before toxicity studies were launched. This is hardly satisfactory, since the protection of support personnel usually requires long-range testing to establish safe, cumulative, or chronic toxicological limits.

The search for new propellants of higher energy content leads inevitably to combinations of hydrogen and light metals with oxygen and/or fluorine. A few of the predicted exhaust products, e.g., boron trifluoride, have inherited some limited toxicological attention from industrial medicine, but the military effort has been slight. An outstanding exception is the ARPA research on the toxicity of beryllium oxide and of beryllium halides.

With respect to bacteriological and chemical warfare, the Panel is aware of the Hanford Committee Report of February 14, 1962.

(g) Physical Fitness and Selection Standards

Repeated changes in physical fitness and selection standards in the past have led to much dissatisfaction on the part of Armed Forces inductees. It is possible for a man to be refused by one Service and recruited by another. The application of specific physical fitness requirements to specific jobs should be given more attention, particularly since the manpower pool is likely to be severely reduced by casualties in case of war.

Some work is being done in this field--but not enough. All Services are concentrating on adaptation of personnel to jobs involving difficult environments. The Air Force's interest in aerospace medical research is an example. There is no current Service-sponsored research on physical standards.

(h) Preconditioning of Personnel to Hostile Environments

Man's capability to adapt to behavioral and physiological factors is of large magnitude. In war, it often determines the course of victory or defeat, as well as actual human survival. This fact is fully known by the military services, and great effort is exerted by the training personnel to provide a high degree of behavioral preconditioning. However, the Services have failed to take full advantage of the benefits that can be gained by advance training. More could be done to precondition men for the rigors of the hostile environments they will encounter in the event of war.

At the beginning of World War II it was sometimes said by military surgeons concerned with this problem that the Services were "marvelously trained for fighting a war between Boston and Washington." Since then, more recognition has been given to the problem, although in recent years the deaths of raw recruits and reservists in hot, humid training areas have been reported.

Factors which must be expected to contribute to the difficulty of military operations include the following:

(a) Heat--including high intensity solar radiation and ultra-violet radiation, and high humidity.

(b) Cold--including damp, wet conditions and snow conditions, as well as difficulties experienced with vision, such as Arctic "white-out."

(c) Acceleration--including problems of impact, vibration, rotation, and sustained linear acceleration.

(d) Altitude--including not only low oxygen pressures but rapid temperature swings, high wind velocity, and high intensity solar radiation.

(e) High Pressures--principally a Navy problem having to do with undersea warfare operations.

At present, a considerable body of information exists, relevant to all the preceding factors. It is based on the sound approach that preconditioning of normal individuals will bring about body and organic adjustment to hostile environments. However, it is possible that some of this valuable information is not being fed into all the training areas where it can be used. For example, the Navy, due to experience in dealing with seasickness, is in the lead on research into the problem of disorientation. Man in space, and a man revolving in the turret of an Army tank, face the same basic disorientation problem as the seasick sailor. Yet the other Services are slow in taking advantage of the Navy's developments.

In the environmental field, numerous areas remain in which further study is needed. Two examples:

1. Development of field techniques for the measurement of environmental parameters, or factors. In general, we lack satisfactory instruments for such field studies. For instance, man can stand exposure to very low temperatures, but his physiological tolerance to

cold is sharply reduced when the wind removes body heat at an increased rate. We have no adequate means of obtaining data to tell us exactly how much man's tolerance to low temperature is affected when accompanied by rapid heat loss.

2. Identification and cataloguing of physiological stresses pertinent to study of hostile environments. The Service laboratories have been undertaking such identification, but practical results have been slow in developing. Private laboratories, such as Haskell Laboratory in Wilmington, Delaware, and the Chamber of Mines Laboratory in South Africa, are surpassing the Service groups in their contributions. This is particularly true in their studies of hot environments.

The U.S. Army Medical Research and Development Command demonstrated its awareness of the problem when it carried out OPERATION SOLIDARITY from 20 January to 17 March 1961. This was an effort to demonstrate the validity of the claims for preconditioning of troops. A complete report of this operation is on file at the Office of The Surgeon General, Department of the Army. The conclusions reached, in brief, are:

1. Pre-acclimatized soldiers are able to perform simulated tactical tasks more efficiently and with fewer heat casualties than their non-acclimatized counterparts.

2. Prior acclimatization to heat permits soldiers to:

   a. March faster in the heat.
   b. March longer in the heat.
   c. Do more load moving in the heat.
   d. Have fewer fall-outs while working in the heat.

3. No relationships between heat acclimatization and foot blisters were found.

4. The time involved in the tests for heat acclimatization (12 days) was not considered sufficient to get the best results.

5. Current information about the duration of the effects of heat acclimatization may be in error because of the lack of complete acclimatization.

This provocative and indicative research so far has not been followed up. The Panel believes it should be. (See Appendix "M").

(i) Hepatitis and Viral Diseases

Hepatitis ranked high among the diseases which incapacitated troops during World War II. In the Mediterranean Theater of Operations, 36,582 cases were reported from January, 1943, to May, 1945. Since it takes approximately six weeks before a soldier stricken with hepatitis can return to active duty, the number of man days lost added up to a blow as crippling as a major military defeat inflicted by the enemy.

In World War II, more than 8 million man-days in all were lost from hepatitis. In the Korean conflict, 1.2 million man-days were lost. Even in peacetime, from 1954 to 1960, the loss amounted to 684,000 man-days. These figures do not include the prolonged convalescence and disability which result from the disease.

Now hepatitis is becoming a problem among the troops that have been sent to Viet-Nam.

(j) Dermatological Conditions

Skin diseases cost U.S. troops the loss of 4.5 million man-days in the Pacific area in World War II. Until recently, practically no research effort has been devoted to this medical problem. Recent proposals for medical research programs in the Department of Army indicate that the Army is conscious of this major problem.

(k) Neuropsychiatric Problems

Neuropsychiatric disturbances--including "battle fatigue"--take a tremendous number of men out of action. It is imperative that an intensive research effort, aimed at protecting the mental health of troops, be mounted. This should be a tri-Service effort.

These statistics tell the gloomy story of the effect of neuropsychiatric disorders in World War II:

> Of the 18 million men screened for military service, 2.5 million--one out of seven--were either rejected or prematurely separated because of mental or emotional defects.
>
> Figured in combat terms, this represents 55 divisions.
>
> Furthermore, 750,000 men were separated from service for psychiatric disability or inaptitude.
>
> Of all separations for medical reasons, 34 percent were for psychiatric disability.

(1) Accidents

Each year the Armed Forces lost far too many men of military combat age through automobile accidents. Most of these accidents occur within a radius of 50 miles of the military base. The Table on Page 13 of the Introduction indicating the percentage of hospital admissions shows the importance of accidents versus battle casualties.

Currently, there is no biomedical research effort in the Armed Forces to find solutions to this problem. Medical personnel are not consulted or directly involved in safety and accident investigations and prevention programs. Accident research formerly was conducted by the Army but the program has been terminated. It should be reinstated and stepped up.

SHORTCOMINGS IN RESEARCH PROGRAMS

The Department of Defense is not getting full value from several of its research programs. To correct this situation, the Panel makes the following recommendations:

1. If an effective program cannot be developed for the reactor at the Walter Reed Army Institute of Research, it should be dismounted because it duplicates existing facilities.

The reactor situation is a puzzling one. It was started in 1952 for the purpose of affording opportunities for studies on radiation injury including physiology, pathology, immunology, dosimetry, and treatment. Because of administrative and construction difficulties, the device has not yet been made critical.

Meanwhile, just a few miles from the Army installation, two other reactors have been built. One is a project of the Army's Ordnance Corps, on the Walter Reed Grounds. In return for the space, Ordnance has agreed to give the Medical Department use of 20 percent of its reactor time. The other reactor is at the Armed Forces Radiobiology Research Institute at the U. S. Naval Medical Center, Bethesda, Maryland. This project is supported by the Defense Atomic Support Agency (DASA).

There is an acute shortage of personnel competent to operate the Walter Reed reactor, as well as to fill other needs. It might be mentioned in passing that this shortage in regard to the Walter Reed reactor project has been aggravated by a rather strange circumstance: the Army program's most capable radiobiologist-officers have been assigned to the DASA unit at the Naval Medical Center.

The Army Surgeon General's Research & Development Command seems aware of the personnel problem. It has supported two career Medical Corps officers in graduate studies in radiobiology. But this is just a drop in the bucket. Many more are needed if the Army Medical Service is to fill its life-or-death function of protecting troops in the field against radiation exposures.

Currently in the Army, there are only 16 officers qualified for basic research in the mechanisms of radiation, and not all of them are available for assignment. Against this, there are minimum

requirements for at least 33 qualified radiobiologists-officers to advise the command in the various theaters, armies, and other headquarters on radiation problems.

In an attempt to deal with this lack of depth in personnel, the Army Surgeon General's office has set up the Professional Education and Training Committee. Within the past year, the R&D Command has been assigned one of the five seats on this committee. The Committee has authorized increased training slots in radiobiology, and is considering other steps.

Such corrective action may give purpose to the existence of the Walter Reed reactor. A coordinated development program for all the reactors of the armed forces may change the picture entirely.

In regard to the above, there is some question as to whether Congress intended for the reactor component to be built at the Walter Reed Institute. The Panel's study of the hearings of the House Appropriations Subcommittee on Military Construction reveals that no specific attention was directed to the reactor component. Construction was approved in Public Law 968-84th Congress.

2. Current biomedical research activities at Fort Knox should be transferred to more appropriate laboratories.

World War II developments made it apparent that intensive research would be necessary to determine man's tolerance to tank warfare. Much study was needed of basic tank design to enable men to use tanks effectively. Accordingly, an Army Medical Service Research Laboratory

was set up at Fort Knox to work with the Armor School. Their cooperation was extremely effective.

Now, however, the Armor Proving Grounds has been moved from Fort Knox to another location, and a large part of the Army Medical Research Laboratory has been transferred to the Environmental Laboratory at Natick, Massachusetts.

The Panel recommends, therefore, that the balance of the Army Medical Service Research Laboratories at Fort Knox be closed. This can be accomplished efficiently by these steps:

The Human Factors research project should be transferred and combined with a similar project at Aberdeen Proving Grounds, Maryland. Psychophysiological aspects of this research could be integrated into a similar program at Walter Reed.

Small remaining bits of the medical research at Fort Knox can be transferred to other AMS laboratories.

Much research activity now is proceeding in the field of non-ionizing electromagnetic radiation at the Fort Knox Laboratory. The Panel feels that this work can be bolstered and carried out in a more orderly fashion by closer ties between physicists, engineers and immunologists.

At present, extension of the studies of the effect of radio frequencies on whole organs is being done even before there has been an evaluation of the effect of such stimuli on simpler systems. This is not conducive to the best interests of research.

A special problem is the large space requirement for instruments needed for the electromagnetic research program. This sharply limits the choice of a new location.

The Panel wishes to emphasize it is of the utmost importance that research into the biomedical aspects of the entire electromagnetic spectrum be developed to the fullest. To mention just one critical problem, it is obvious that development of masers and lasers will require intensive research to learn exactly what effect they will have on human tissues. This is an entirely new area, and one which almost certainly can have serious disabling consequences for humans unless handled properly. At present, there is only a handful of people in the Services' medical departments competent to approach this type of research. A training program of the highest priority should be instituted immediately.

3. Duplication of activities by the three Services in the development of protective clothing should be eliminated.

As examples of such duplication, the Panel found that two or more of the Services were working separately on pressure suits, a multiplicity of helmets, and body armor. (See Appendix "M") This is both expensive and manpower-consuming, and should be stopped.

4. In carrying out basic research into various physical environmental factors, one central laboratory in each major area

should be given responsibility to coordinate and clarify objectives. Thus, each Service then could apply itself energetically and without diversion to the developmental problem.

5. Each of the Armed Forces' general hospitals with teaching responsibilities should have a Director of Clinical Research or a Director of Experimental Medicine. This director would manage these problem areas. He would strive to get the best use from clinical material and research talent.

Clinical Research

In general, biomedical research is divided into two categories: (1) A program oriented directly toward improvement of patient care, and (2) another which deals primarily with long-range protection of persons from a variety of hostile environments.

The former is usually called clinical research and deals with many subjects such as shock, trauma, improved surgical techniques, and medical therapeutics. The latter is concentrated primarily on a number of physiological studies of how the body's mechanism adapts to a variety of stimuli from temperature changes to noise.

Clinical investigation currently is inadequately supported. Hospital administrations have neither funds nor adequate personnel to assign to this field. Any research carried out by personnel assigned to patient care must be done in free time. Usually, it involves work by the medical officers on evenings or weekends, if and when the work

does not interfere with other clinical responsibilities. Expenditure of funds must be limited to direct patient care. R&D personnel as a rule do not have clinical facilities available to them unless they can assume responsibilities for patient care.

Equipment and instrumentation present another problem. An example is the specialized equipment needed for catheterization of the chambers of the heart. This procedure is extremely valuable in diagnosis of certain types of heart defects and can be used as a diagnostic tool. It is also used in research approach to the study of heart disease. In some hospitals research aspects are limited and diagnostic procedures are used daily. The differences in opinion in the individual hospitals lead to delay in acquiring the instruments and problems in developing teams to perfect techniques for effective use.

A bright spot in the picture is a narrowing of the gap between people interested in clinical research and those interested in fundamental biomedical research. The concept of clinical research as an applied form of basic research is not longer as rigid as it once was. These changing concepts will bring about a closer relationship between the clinical treatment centers (the hospitals where the patient problems are presented) and the research laboratories. At present this relationship is highly variable.

Emphasis should be placed upon the need for maintaining the balance between the programs. The clinical research worker must learn to accept the workers in the so-called fundamental areas as equal

partners. The same holds true for the laboratory scientists. One program should not be developed at the expense of the other. Many fundamental problems have not been solved as yet, and work must continue at an accelerated pace in these fields. The real goal is a close working relationship between clinical medicine and fundamental research. This cannot be accomplished by administrative order. It will come only when there is a full understanding of the mutual interests of each, followed by a frank and complete interchange of opinions.

The problem of the gaps in the work is much more serious than the problem of overlap and duplication. The major reasons for inadequate cover of the field are lack of competent and interested personnel, lack of money, and lack of interest. The lack of interest often is a result of forced choices. Gaps in the area due to poor communication exist but are probably secondary in importance.

PART IV

IV. Personnel for Military Biomedical Research

1. The number of scientist officers assigned to biomedical research and development activities should be based upon actual research and development needs. The number of these specially trained officers should bear no relation to troop strength.

The Department of Defense and the Services must take a critical look at the structures of their organizations. The Departments must make sure they are going to have enough trained personnel to meet the growing requirements. (See Appendices "D", "E", "F").

Medical Corps

Uniformed personnel constitute nearly one-half of the staff of biomedical research laboratories. This is in sharp contrast to non-biomedical research where nearly all of the personnel are civilians. No other Corps of the Armed Forces has this professionally trained group.

This is due, partly, to the discipline of education in the civilian medical schools. The graduate has been taught a three-pronged approach to his profession-teaching; clinical care of patients, and research. He expects to be able to participate in all three fields. Consequently, he is confused when he is recruited into the Armed Forces to find such sharp lines of demarcation between these three areas. The medical graduate's ability and desire to do research can be utilized as an effective recruiting argument.

The current system of financing research in the Department of Defense is another reason for the high percentage of uniformed personnel in the biomedical laboratories. Their salaries are not included in the R&D budgets. However, salaries of civilian personnel definitely are part of the expenditures of each of the research installations.

Over a period of many years, the appropriations for biomedical research and development in the Department of Defense have remained the same. Salary increases must be absorbed by the budgets of research installations. More and more uniformed personnel must be assigned to the laboratories in order to maintain work schedules. Because of the scarcity in the three Services of career medical officers who are devoted to research, it has become necessary to use officers, obligated for two years of military service as research workers.

The uniformed medical research workers are taken from a personnel pool which furnishes investigators, clinicians, and medical commanders. This pool has been limited to 3.4 officers for each 1,000 troop strength for the Army and Air Force, and 3.7 for the Navy. Recently there have been indications that this ratio may be changed. Nevertheless, at present the number is barely sufficient to discharge day-to-day clinical responsibilities to troops and their dependents, to the medicare program, and to the steadily increasing number of retired personnel in Service hospitals. The number of officers assigned to a mission must be sufficient to meet these requirements.

While the use of two-year obligatory officers serves a definite training function it is wasteful in the use of current R&D funds. A two-year man puts out approximately 16 months of useful work in his 24 months of service. His working time is cut down by his indoctrination periods, his 60-days vacation, his sick leave, etc. Frequently, the delays in his usefulness are caused by lack of apparatus. With proper leadership and with integration of these men into on-going programs, their services could be utilized more efficiently. However, when these men are permitted to set up their own program and requisition apparatus for it, delays and waste occur.

A unique characteristic of biomedical problems is the high inherent level of complexity. Many interrelated factors or balances are involved in any one subject. As a rule, biological phenomena cannot be defined in pure systems. Actually, they are a number of interrelated systems. Alterations in one system may produce compensatory alterations in others, thus obscuring the end result. Because of this, relatively more effort must be devoted to the research aspects of biomedical problems than to development. The Department of Defense recognizes this. On page IV-9 of "Management of Research Development and Test Evaluation Programs, U.S. Army, July 1961" a table for fiscal year 1960 shows that there was one development program and 32 research projects in the medical department. This contrasts with technical services, such as Ordnance, where there are 163 development programs and 36 research projects.

The table referred to follows:

Dollar Magnitude (thousands)	R&D Projects by Developing Agencies - FY 1960						
	Ord	Sig	Chem	Engr	CM	Trans	Med
0 - 100	-	1	-	-	-	-	-
101 - 500	2	11	-	1	-	1	-
501 - 1,000	9	13	-	2	-	1	-
1,001 - 5,000	55	41	5	17	7	1	1
5,001 - 10,000	41	13	4	5	9	3	-
10,001 - 20,000	27	16	4	10	1	2	-
20,001 - 30,000	11	8	1	-	-	2	-
30,001 - 40,000	3	3	2	-	-	2	-
40,001 - 50,000	2	4	-	-	-	2	-
50,001 - 60,000	2	1	-	1	-	-	-
60,001 - 70,000	-	1	-	-	-	-	-
70,001 - 80,000	1	-	-	-	-	2	-
80,001 - 90,000	-	1	-	-	-	1	-
90,001 -100,000	3	-	-	-	-	-	-
100,001 -500,000	5	3	-	-	-	-	-
500,001 -and over	2	-	-	-	-	-	-
Total development projects	163	116	16	36	17	17	1
Total research projects	36	21	22	11	10	9	32
Total projects	199	137	38	47	27	26	33

2. Optimally, command control of biomedical research installations of the Armed Forces should be assigned to uniformed officers with primary military occupational specialities in research and of recognized competence.

Military medical research must meet the urgent problems of health and environmental protection in modern warfare. In order to do so, there must be an adequate understanding of research needs on all management levels, where funds, personnel, and procedures are allocated and controlled. It is not necessary--even though it is desirable--that all senior administrators and commanders of biomedical activities have extensive research experience. However, it is essential that those involved in the planning and direction of research activities do have such experience. This will enable them to appreciate more fully the research process. It also will increase the effectiveness of their contributions to military operations.

The Armed Services Medical Departments have produced a gratifying number of capable individuals who are equal to the highest requirements of their offices, in both the clinical and research areas. Unfortunately, this number has been drastically cut by the high rate of resignations. Thus, the Armed Forces laboratories are faced with a serious potential deficiency--the lack of competent supervisory professional personnel of a high scientific level.

Three of the major causes for separation are: the unsatisfactory planning of the research programs; the instability of

budgetary support; the arbitrary rotation of key men in established research teams, and the inability to replace them. As noted, the number of voluntary resignations among senior personnel runs high. There also is difficulty in recruiting medical researchers into the junior ranks of career officers. Consequently, prospects for maintaining an officer corps of the highest caliber are poor indeed.

Competence and Utilization of Scientific Personnel

The Panel found highly competent and dedicated scientists in many of the laboratories visited; however, such men were all too few.

Unfortunately, these superior scientists all too often are assigned to unproductive tasks. They also are handicapped by frequent turnover of their supporting personnel; by whims of commanding officers with little or no understanding of research, and, occasionally, by inadequate facilities.

On the other hand, the Panel found many mediocre scientists, who possess considerable technical skills but whose competence to conduct independent research programs is questionable. The competent scientists should be spread out more through the various research centers. Their imagination and leadership might spark the less gifted individuals into becoming effective members of a research team.

Scientists in military uniform contribute relatively little to the overall research program--with a number of notable exceptions.

Almost half of the officer "scientists" are young physicians completing their two years of obligatory military service. Usually, they prefer research to infirmary duty in some remote installation, but their lack of experience renders them relatively ineffective as investigators.

The Director of Research

The functions of the scientific director of each laboratory are of the greatest importance. In a laboratory with a clearly defined mission, the scientific director must operate effectively in three ways: He must recruit key personnel, arrange for their adequate support, and provide intellectual leadership and guidance.

The Panel did not find too many examples of directors who met all of these difficult requirements.

Poorly defined missions make outstanding scientific direction even more difficult in a number of laboratories. In such cases, where the mission is vague, it is the director who must decide what the research program is to be. In large measure, the inadequacy of leadership, coupled with the lack of clearly defined missions, can be blamed for ineffective programs in many laboratories.

The success of a laboratory also reflects the personality of its commanding officer. It depends greatly on the relationships he has established with both his own military superiors and with the scientific director; also, on the depth of his own understanding of his laboratory's scientific programs. The scientific director under the commander

must serve as the policy-making administrator of the laboratory. The military commander, even if he is a medical officer, must understand that his role is to implement. He must provide the scientific staff with maximum support, and facilitate research in a military environment.

Productive biomedical research is being conducted under a wide variety of circumstances within the Services. Under a wise commanding officer or civilian research director, outstanding scientific progress can be made, regardless of vagueness of missions, or, even, inadequate facilities.

Civilian Personnel

3. Civilian scientists should be given recognition and status comparable to that given uniformed personnel.

Continuity of employment and the caliber of civilian scientists are important elements in the successful operation of research laboratories, particularly in view of the rotation of uniformed laboratory personnel. Young civilian scientists are attracted to research positions in military biomedical laboratories because of excellent facilities, and salaries which are comparable to or higher than starting scales in universities and industry. Thus, during the period of training, a young scientist tends to be drawn to government laboratories.

Unfortunately, however, when he reaches the level of senior investigator, a reverse process takes place. At this level, government

salaries and other benefits are below those of universities and industry. Consequently, the government is deprived largely of the peak productivity of a professionally mature scientist. This, in turn, makes it more difficult to hold the younger scientists as there are so few outstanding men left to attract them. (See Appendices "D" and "F").

To add to the problem, civilian employees are often treated as second-class citizens. They are provided with inadequate housing and eating facilities. Their access to the uniformed command is limited. They are not permitted to live on military posts, which creates serious transportation problems in isolated areas.

Probably the most important handicap for civilian scientists is the structure of Civil Service regulations. The Cordiner Committee, in its 1957 "Report of the Defense Advisory Committee on Professional and Technical Compensation," stated:

> "Increasing losses of talent and the lack of input at the bottom cannot long continue without serious effect upon the military establishment."

The Cordiner Committee felt the Defense Department mission had much to offer career Civil Service personnel. However, because of inadequacies in compensation, prestige, and opportunities for advancement, the alarming loss of engineers, scientists, and managers was creating a critical situation.

The salary structure for civilian personnel was highlighted as the basic cause of the problem. Fixed by statute, it cannot compete with industrial salary structures. The Second Hoover Commission, in its "Special Personnel Problems in the Department of Defense," pointed out the same problem. (Appendix B).

Present Federal personnel practices seem to work like a sieve. By constant shaking, the better scientists are allowed to fall through.

To attract and retain scientists in the Defense Department research effort, they must be regarded as the peers of their uniformed co-workers. There must be greater flexibility in the promotion system, increased opportunities for constructive work, and stability of program.

Military Personnel Problems

4. The assignment of all personnel with a primary military occupational specialty in research should be with the consent and advice of the R&D command. There should be a promotion channel, based on accomplishment, for R&D personnel.

The rotation system of the Armed Forces automatically deprives the biomedical field of a continuing career group of research-oriented officers. This practice is planned basically to provide a larger number of officers with command experience. But it also has the disadvantage of not permitting the specialized career development which is necessary in biomedical research and development.

The Services should take a fresh look at this officer assignment policy. This rotation problem is not unique to the biomedical research area but is common to all research in the Department of Defense. It is aggravated in the biomedical field by the high percentage of uniformed officers involved in the research effort.

5. It is recommended that The Secretary of Defense authorize specialist pay to selected officers and enlisted men. Particular attention should be given to the non-medical allied scientist officers holding doctoral degrees.

There is a body of medical service personnel comprised of scientists and non-scientists--hospital administrators, pharmacists, podiatrists, chemists, bacteriologists, sanitary engineers, physiologists, and others. Many members of this corps are trained in specific fields of research and hold Ph.D. degrees. Their presence is essential for the military biomedical programs but, by law, they receive lower pay than the Medical Corps. By custom and by interpretation of the statutes, they are excluded from flag or general officer rank, which automatically prevents their serving in high level policy-making positions.

Not all the specialists engaged in highly productive research work hold Ph.D. degrees--and all of the Ph.D.'s are not necessarily the outstanding workers. Many of the best men in the field hold lesser degrees. The recommendation for providing incentive pay for competent specialists takes the competence factor into consideration. The Panel

feels it would enable the laboratories and the R&D command to reward outstanding skills in military scientists and research workers. In addition, it would have the advantage of not creating a select group whose distinguishing qualification is the advanced degree.

6. Every effort should be made to set up an active, aggressive recruiting and training program for medical and non-medical scientist officers in the research and development program.

One of the most serious limitations in civilian medical education is the waste of a young man's talent when he has completed his hospital residency. He is confronted with many problems and is not easily absorbed into medical practice. This situation does not exist in the Armed Forces, and such men can be placed immediately in productive clinical or research programs.

Many medical school graduates wish to remain in full-time teaching or research. They would be available for military medical research programs if conditions were more attractive. The recruitment of medical and allied scientist officers for these programs will depend largely on the challenges which the Services can offer. Greater professional career opportunities are definitely required to recruit the needed officers for military biomedical research programs.

There are many fundamental personnel problems affecting the Medical Service Corps of the various services. In the Army, there are 4,000 MSC officers, but only 180 are allied scientists. The remainder of the appointments are to helicopter pilots, administrative officers, psychologists, and so forth.

Of the Navy's 1,346 MSC officers, 237 are allied scientists, but only 100 are in research billets. The other 137 are in research administration in hospital clinical laboratories, or are working as clinical psychologists.

In the Air Force the system is essentially the same.

In all three Services, the assignment of an MSC officer to a hospital is not governed by his specialty. A hospital center or laboratory may be allowed a number of slots for MSC personnel. If these places are filled by psychologists or by administrative officers, then--even though a shortage in the allied scientist requirements exists--no more MSC personnel may be assigned to that installation.

For example, at Walter Reed Army Institute for Research there was an over-strength of research psychologists. A bacteriologist was badly needed. But it was impossible to assign a bacteriologist to the one laboratory because the Institute's roster showed an overstrength of MSC officers.

There is a great need for allied scientist Medical Service Corps officers in the research program. The multidisciplinary approach to biomedical research demands personnel with specialized training beyond that usually available to a doctor of medicine. The method of assigning MSC officers--both within the Corps and to installations--should be changed. Personnel should be assigned on the basis of the installation's requirements--not on the basis of numbers.

In the Army, the Surgeon General has the authority to try to meet specific requirements within the MSC allotment by appointing needed specialists. There is a five-year plan which the Surgeon General has proposed and which the Director of Defense, Research and Engineering has accepted, but the Army's current roster of 180 allied scientists does not begin to anticipate the future needs. The Surgeon General should review the present specialty assignments in the MSC and increase the allotments for allied medical scientists.

Biomedical research is becoming increasingly vital to the Armed Forces. But as its importance grows, so does its complexity. It requires the integration of a large number of medical and non-medical disciplines ranging from mathematics, statistics, physics, electronic engineering, to anthropology. Therefore, adequate numbers of competent scientists representing these skills must be recruited--and retained--for defense laboratories.

The Armed Forces must meet the competition for similar personnel from universities, industry, and other government agencies. In the field of radiobiology, for example, this is particularly strong. The National Aeronautics and Space Administration is developing a radiobiological program at its Ames Research Center in California. NASA has an advantage over the military. It has a large number of GS-15 and higher positions alloted to it. If NASA completes its program of recruiting approximately 300 radiation biology scientists, it will have cornered the market on practically all the talent in this area in the United States.

PART V

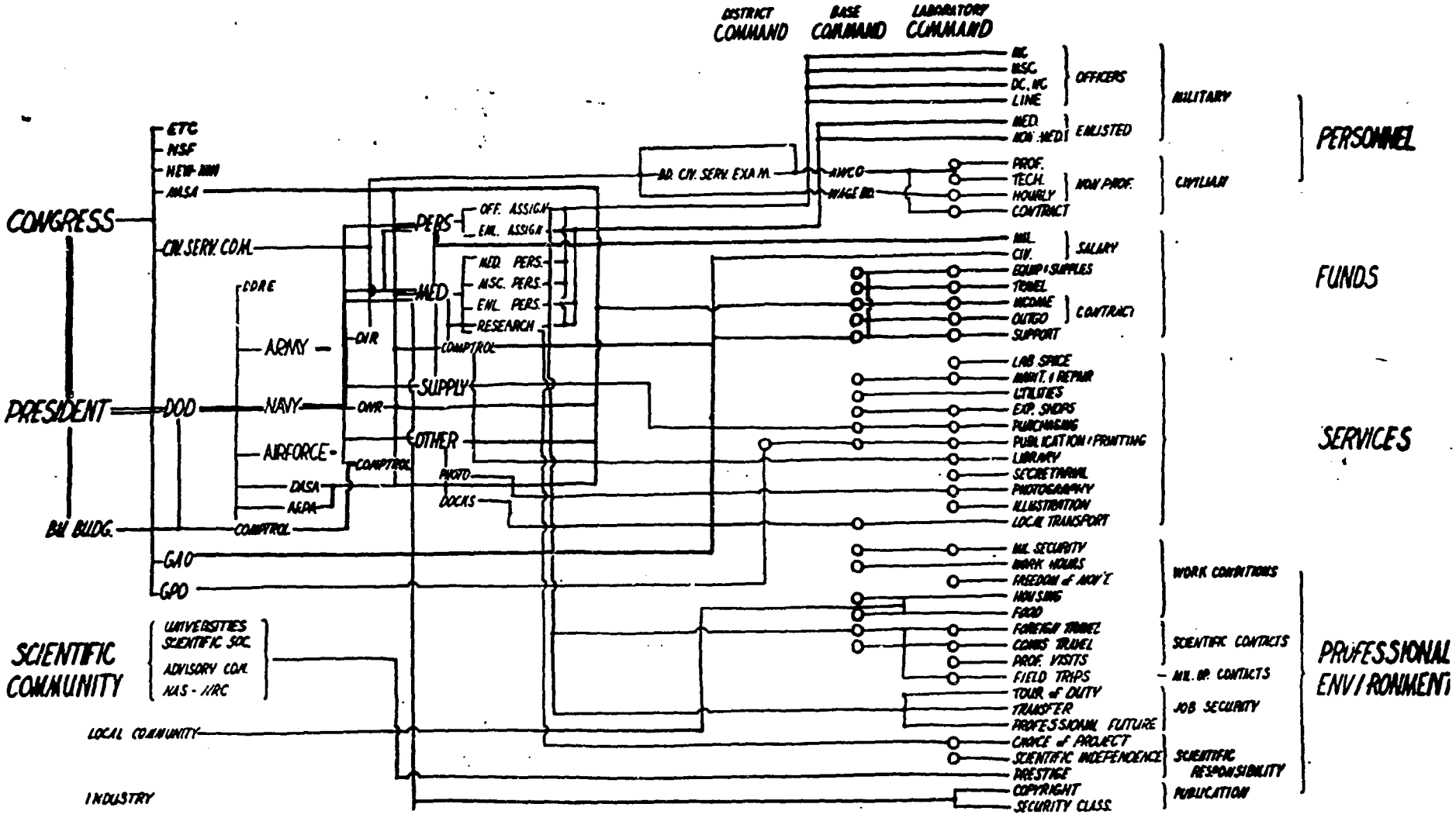
V. Organization and Administration of Biomedical Research and Development

1. The annual biomedical budget for research and development should be expended throughout the year in a manner conducive to the best support of research.

Research funds come from various sources: Medical Department R&D funds, appropriations for construction, maintenance budgets, and direct contracts with other technical services and Government agencies. As these funds change, research support fluctuates, making it difficult for laboratory personnel to do any effective long-term planning. In addition, "crash" programs and orders from higher authorities cause sudden disrupting changes in current projects. The lack of stability and the inability to adhere to long-range plans add to the difficulties of the Service laboratories in recruiting research personnel.

Laboratories located in a center or on a military base have administrative obligations to the base commander who is not concerned with research but who may control the expenditure of funds. This results in administrative procedures which frequently interfere with the laboratory's efficiency. Then, too, procurement procedures are often controlled by regulations originating in remote headquarters which are insensitive to biomedical research problems. (See Chart I)

At present, there is a system, especially in the Army, of holding back large amounts of funds in the early quarters of the fiscal year


DISTRICT COMMAND
BASE COMMAND
LABORATORY COMMAND
CONGRESS
PRESIDENT
B/J BUDG.
ETC
NSF
NEW-
NASA
CIV. SERV. COM.
DOD
ARMY
NAVY
AIRFORCE
DASA
AEPA
COMPTROL
CORE
OVR
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GAO
GPO
SCIENTIFIC COMMUNITY
UNIVERSITIES
SCIENTIFIC SOC.
ADVISORY COM.
NAS - NRC
LOCAL COMMUNITY
INDUSTRY
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MED
MED. PERS.
MISC. PERS.
ENL. PERS.
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NAVCO
WAGE BD.
MC
MSC.
DC, NC
LINE
OFFICERS
MED.
NON-MED.
ENLISTED
PROF.
TECH.
HOURLY
CONTRACT
NON PROF.
MIL.
CIV.
SALARY
EQUIP + SUPPLIES
TRAVEL
MODIFIC
OUTSIDE
CONTRACT
SUPPORT
LAB SPACE
MAINT. + REPAIR
UTILITIES
EXP. SHOPS
PURCHASING
PUBLICATION / PRINTING
LIBRARY
SECRETARIAL
PHOTOGRAPHY
ILLUSTRATION
LOCAL TRANSPORT
MIL. SECURITY
WORK HOURS
FREEDOM of MOV'T
HOUSING
FOOD
FOREIGN TRAVEL
CONUS TRAVEL
PROF. VISITS
FIELD TRIPS
TOUR of DUTY
TRANSFER
PROFESSIONAL FUTURE
CHOICE of PROJECT
SCIENTIFIC INDEPENDENCE
PRESTIGE
COPYRIGHT
SECURITY CLASS.
MILITARY
CIVILIAN
WORK CONDITIONS
SCIENTIFIC CONTACTS
MIL. OP. CONTACTS
JOB SECURITY
SCIENTIFIC RESPONSIBILITY
PUBLICATION
PERSONNEL
FUNDS
SERVICES
PROFESSIONAL ENVIRONMENT

and not releasing the money until the final quarter. Accordingly the Army acquires laboratory hardware, but it does not get the best use of its scientific manpower.

The "hold-back" technique is a result of the system of common funding for both research and development. When development costs in any branch exceed the allowance, money is diverted from research projects in any branch to balance the budget.

The Army, Navy, and Air Force - three independent Service groups - are responsible for organization and administration of biomedical research in the Defense Department. This top-heavy administrative machinery and separation of people and programs that should have close contact results in a high incidence of duplication and major gaps in the research program.

The above problem is common to all military research and development. However, some unique differences stand out in biomedical research installations. Located usually in large hospital centers, these installations are under the jurisdiction of the medical officer in charge of the entire center or base. He is a clinically-oriented officer who is basically responsible for patient care and hospital management. The fact that he is a physician does not guarantee that he has the training and feeling necessary for a sympathetic understanding of the research installation under his command.

The Panel calls attention to an earlier recommendation in this report: that only men trained in the research field should command and control research installations. This recommendation must be extended

through the management of these large centers and installations; when command functions obviously are intended to cover military housekeeping, administrative responsibilities for research must be excluded.

2. Administrative control of research installations should be returned to the R&D Command.

There is a multiplicity of administrative controls in military research laboratories. These controls deal with program management, funding, enlisted personnel, civilian personnel, maintenance, housekeeping, equipment, supplies, and supporting technical service. Medical officers and Medical Service Corps officers are under the direct control of the Medical Department. Enlisted personnel are controlled by G-1 or the Technical Services concerned. Civilians are controlled by the Civil Service System.

This hydra-headed system is cumbersome and top-heavy, and it hinders the laboratories in their effective pursuit of their missions.

3. To correct duplication and inefficiency in present biomedical research, full responsibility for all research in a given major area, such as infectious diseases, trauma, radiation hazards, and so forth, should be assigned, where possible, to a single laboratory. As an alternative, vigorous steps should be taken to coordinate the efforts of the several laboratories

which may be working in the same area. Broad changes in programs or levels of activity should require approval in the Office of the Secretary of Defense on behalf of the three Services.

4. If Recommendation 3 in this section cannot be carried out, universities or other outside agencies should be assigned the management of crucial programs.

The Panel believes that the current military biomedical research and development capabilities are dissipated over too many laboratories. The laboratories vary in size -- some have two or three officer scientists while others have more than a hundred. The very small units usually are attached to some other agency. Although these small units often lack the "critical mass" of scientists needed for effective work, they sometimes produce an unexpected volume of results. A good example is the Army's Kuala Lumpur laboratory in Malaya.

Biomedical research laboratories in isolated areas may have few workers in a particular discipline. As the distance between laboratories increases, communication between scientists decreases. This leads to undesirable duplications and wasted efforts.

In the area of radiation and radiation biology, an example of this lack of communication is presented. The Air Force Laboratories at the

School of Aviation Medicine at the Brooks Air Force Base, and at Holloman Air Force Base duplicate almost completely the programs of both the U. S. Naval Radiological Defense Laboratory and the Walter Reed Army Institute of Research. There is less overlap with the Armed Forces Radiobiology Research Institute at Bethesda. Communication appears to be ineffective at all levels.

A good research organization operating in an area of multi-disciplinary requirements should be large enough to bring together a "critical mass" of scientists to deal with the problems at hand. Effective interaction can take place only if all relevant disciplines are represented. Since the number of good scientists the Department of Defense laboratories can attract is limited, maximum utilization of these scientists becomes increasingly important.

5. Formal meetings of research and development personnel, particularly at the Division Chief level, should be held periodically. Adequate travel funds for this purpose should be provided.

At the initial meetings, the Panel was told by the "top echelons" that there was a minimum of formal communication between the Services at high levels. Communication too often depended on informal "bench-level" relationships between laboratories and Services.

The Panel is aware that monthly meetings between the Chiefs of the Medical Research and Development Commands of the three Services recently

have been instituted. But a review of the minutes of the early meetings fail to reveal that the discussions dealt with the broad scope of the total problems. Nor is there any evidence that the content of these limited discussions was passed down to the working levels. Thus, the Panel is forced to conclude that "bench-level" communication, in reality, simply does not exist.

The breakdown and failure in communications is further heightened by inter-Service and inter-laboratory rivalries.

An example of this failure was evident at the time of the Panel's original briefings. The Panel talked with representatives at the Office of Science in the Office of the Director of Defense Research and Engineering, and with the Deputy Assistant Secretary of Defense for Manpower; neither of these offices was aware of the medical activities of the Director of Research in the Office of the Assistant Secretary of Defense for Civil Defense.

When communications fail at various levels, research and the implementation of its findings are impeded. Investigators in the same area of research but in different laboratories - even within the same Service - rarely have frequent and direct contact. Communication between the laboratories, the field, and intelligence sources should serve continually to sharpen the laboratories' awareness of mission, as well as to hasten the field testing and application of research findings. All too often, however, such communication is negligible.

6. Adequacy of Facilities

In general, the physical facilities and scientific equipment of biomedical research laboratories within the Department of Defense are on a par with the best laboratories in industry, universities, and private and public institutes. The growth of physical facilities appears to have exceeded the availability of scientific staffs capable to use them. At present, however, a few excellent programs are handicapped by inadequate facilities. Among these are: (1) the blood preservation program at Chelsea Naval Hospital; (2) the surgical research program at Brooke Army Medical Center, and (3) much of the program at the Naval School of Aviation Medicine at Pensacola.

Important Role for Research Management in a Mission-Oriented Organization

The management of research in a mission-oriented organization becomes a major function. Management must decide which lines of research to encourage, which projects to discontinue, and what kinds of scientists to hire.

In a university, most research and planning for research is done by the scientists themselves. However, in a mission-oriented organization, management must take responsibility for evaluating and funding research in the light of its contributions to the organization's goals. Management must motivate the scientists to engage in research designed to contribute to those objectives.

In addition, management must keep current with progress of the research. Only by so doing can it modify the objectives and exploit the results of research to achieve the greatest good.

Competent and useful biomedical research currently is underway in many of the installations studied by the Panel. The significant factors in effective research appear to be:

(a) A clearly specified mission.

(b) A competent technical director.

(c) An understanding and effective commanding officer.

(d) A competent scientific staff.

A factor which leads to favorable results in research is the establishment by a laboratory of a sound working relationship with other agencies and institutions. For example: The excellent viral and immunological research at Camp Lejeune is due largely to a useful arrangement with the NIH. The staff at the Naval Radiological Defense Laboratory and the Navy Biological Laboratory at Oakland, interacts frequently and well with its colleagues at the University of California.

Also, the flow of university personnel through NAMRU II and III plays a large part in making the work of these installations effective.

All laboratories have been provided with a "statement of mission." In some instances, the mission is clearly and even narrowly defined. The Blood Preservation Research Laboratory at Chelsea is an example. Others, such as Naval Medical Research Institute, Walter Reed Army Institute for Research, and Army Medical Research Laboratory, have a mission which is defined in very broad terms.

As previously stated, a commanding officer who lacks understanding can exert a deteriorating effect upon a laboratory's scientific accomplishments. There is reason to believe that the laboratory with a limited, well-defined mission may be less susceptible to such deterioration than a laboratory of comparable size with a less precisely stated mission.

Almost without exception, research at laboratories with limited and well-defined missions produces useful information, concepts, or equipment clearly related to the Armed Forces' needs. Morale and esprit de corps at such places is notably high.

It should be recognized that even laboratories which are highly mission-oriented frequently produce results of general value to biology and medicine. This was particularly evident in the excellent program at Chelsea Naval Hospital.

In sharp contrast were laboratories such as NMRI and Fort Knox, where there is almost a complete lack of "sense of mission." Here,

leadership had not been effective, and the morale of the depler morale of the depleted staffs - both military and civilian - was relatively poor. Some scierely poor. Some scientific investigators at NMRI and Fort Knox had been successful in trien successful in triumphing over local difficulties and identifying specific military probecific military problems on their own initiative. On the whole, however, much of the reseer, much of the research showed little or no relationship to military needs, and, in gery needs, and, in general, was inferior in quality.

These problems of the larger laboratories come from the bries come from the lack of precise definition and information - not from the broad scope rom the broad scope of the missions. The Panel does not believe there is any place in the is any place in the Department of Defense for a broad biomedical research institutal research institute limited only to exploration of human biology. However, there is a defever, there is a definite place for large laboratories with broad and even diverse missid even diverse missions. These can serve the military establishment well. But - to rei well. But - to reiterate - each should be provided with a set of clearly defined, althougrly defined, although not restrictive, missions and with excellent leadership. eadership.

There is need in each of the Services for one laboratory · for one laboratory - or perhaps unified laboratories - with a broad mission. This need mission. This need is based on the impossibility of foreseeing future research challenges research challenges and the necessity of responding rapidly to changing requirements. Effg requirements. Effective leadership must be provided - especially in the broad-mission h the broad-mission laboratories - to enable these vital centers to remain productive anremain productive and continuously oriented toward solution of Service problems. ervice problems.

PART VI

VI. Administrative Recommendations

Present biomedical resources of the military establishment and of the nation are not effectively integrated into military planning and operations. In the Panel's judgment, this is cause for grave concern for the national security. Our survival may depend on the provision - immediately - of a nucleus of military and civilian personnel, familiar with military planning and operations, who can fully appreciate and help others to understand the following:

(a) The potential gains available through the identification and solution of our present military biological and medical problems.

(b) How to plan and manage a program that will apply this knowledge to military problems effectively. To accomplish this, it is imperative that serious problems of policies and organization also be resolved.

Except in widely separate instances, we are failing to explore and utilize the biomedical sciences adequately for their potential contributions to the military effort. (This does not apply to the clinical activities of the medical services.) There is scant understanding of what the biomedical sciences can contribute toward a more effective solution of military problems. Consequently, in this

field, there is little policy, little responsibility, little organization--and even less enthusiasm.

The reasons for this lack of understanding and activity have become evident in the course of the Panel's discussions and interviews. In the Department of Defense, biology and medicine are not represented in--nor do their personnel have access to the higher levels of civilian or military policy-making or planning which:

(a) Govern the development of new weapons systems;

(b) Decide the probable environments in which men not only must exist but also must be able to perform efficiently; and

(c) Identify problem areas and methods of operation in limited or full-scale warfare. There is no one who has the responsibility for translating policy or plans into the kind of action that is needed. The Panel has in mind action that would lead to the identification of both the overt and the latent medical and biological problems, and to the optimum application of existing knowledge and resources toward solving these problems.

At present, biomedical responsibilities exist in these three major divisions of the Department of Defense:

(a) Assistant Secretary of Defense for Manpower.

(b) Assistant Secretary of Defense for Civil Defense.

(c) Director of Defense Research and Engineering.

Within the ODDR&E there are several agencies now involved in biomedical research.

(a) One is headed by the Deputy Director for Research and Information Systems. He has under him a Medical Sciences branch, headed by the Assistant Director. This is the major budgetary review center in the Department of Defense for the three Services' biomedical programs.

(b) The Director for Engineering and Chemistry is involved in the Bacteriological Warfare-Chemical Warfare programs. These programs have a large medical component.

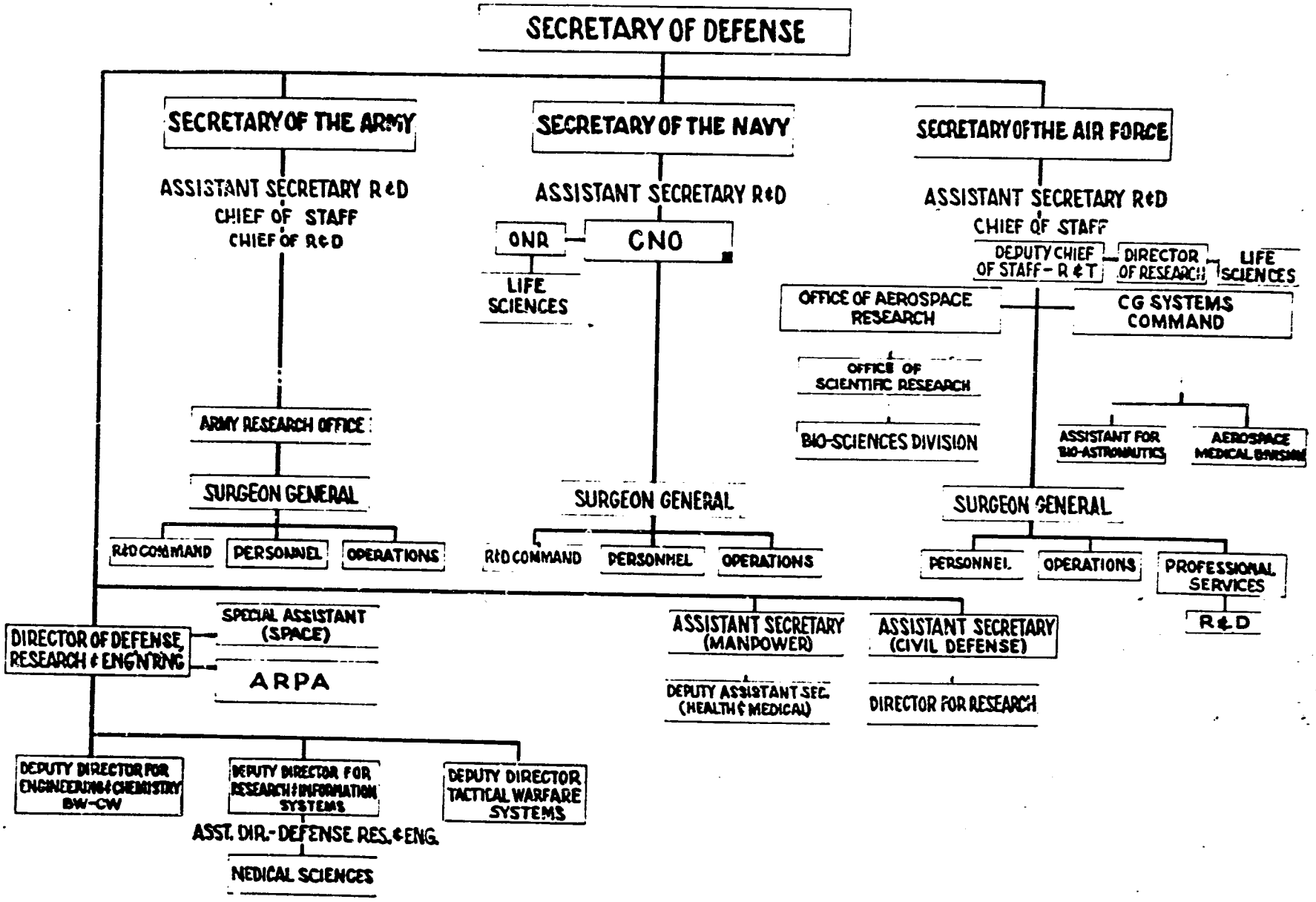
(c) The Deputy Director for Tactical Warfare Systems is engaged currently in medical problems of the limited warfare areas.

(d) The Special Assistant for Space is concerned with bioastronautics and its biomedical programs.

(e) The Director of Advanced Research Projects Agency (ARPA) also has some biomedical programs funded through his office.

(See Chart II)

Nevertheless, at this time, there is no one within this same ODDR&E who is reviewing the clinical research programs. Nor is there anyone who ties together the clinical problems and the basic biomedical research problems.


SECRETARY OF DEFENSE
SECRETARY OF THE ARMY
SECRETARY OF THE NAVY
SECRETARY OF THE AIR FORCE
ASSISTANT SECRETARY R&D
CHIEF OF STAFF
CHIEF OF R&D
ASSISTANT SECRETARY R&D
ONR
CNO
LIFE SCIENCES
ASSISTANT SECRETARY R&D
CHIEF OF STAFF
DEPUTY CHIEF OF STAFF - R&T
DIRECTOR OF RESEARCH
LIFE SCIENCES
OFFICE OF AEROSPACE RESEARCH
CG SYSTEMS COMMAND
OFFICE OF SCIENTIFIC RESEARCH
BIO-SCIENCES DIVISION
ASSISTANT FOR BIO-ASTRONAUTICS
AEROSPACE MEDICAL DIVISION
ARMY RESEARCH OFFICE
SURGEON GENERAL
SURGEON GENERAL
SURGEON GENERAL
R&D COMMAND
PERSONNEL
OPERATIONS
R&D COMMAND
PERSONNEL
OPERATIONS
PERSONNEL
OPERATIONS
PROFESSIONAL SERVICES
R&D
DIRECTOR OF DEFENSE RESEARCH & ENGINEERING
SPECIAL ASSISTANT (SPACE)
ARPA
ASSISTANT SECRETARY (MANPOWER)
DEPUTY ASSISTANT SEC. (HEALTH & MEDICAL)
ASSISTANT SECRETARY (CIVIL DEFENSE)
DIRECTOR FOR RESEARCH
DEPUTY DIRECTOR FOR ENGINEERING & CHEMISTRY BW-CW
DEPUTY DIRECTOR FOR RESEARCH & INFORMATION SYSTEMS
DEPUTY DIRECTOR TACTICAL WARFARE SYSTEMS
ASST. DIR.- DEFENSE RES. & ENG.
MEDICAL SCIENCES

Biomedical research programs make their contributions to operational activities through the Surgeons General of the three Services. And questions that require research are raised in the Medical Department's field operations.

There must be a sweeping recognition within the entire defense establishment of the urgency of increased biomedical participation in policy and plans. The Biomedical Research Program must become a true partner in coordination of activity and responsiveness to military planning. To achieve this, it would be highly desirable to create what would be a focal point in the Office of The Secretary.

Toward this end, the Panel recommends:

1. A plan of organization and a statement of responsibilities -- with recommendations as to how they can be discharged effectively -- should be developed and placed before The Secretary of Defense
   (a) Centralization of responsibility for defining all biomedical clinical and research activities in one office, within the Office of the Secretary of Defense. Provision should be made for adequate liaison with other divisions of the Secretary's Office which have obligations in the field.

(b) Coordination of budgetary responsibility for all programs involving biomedical research and development, clinical care, manpower, and procurement.

There are several possible locations for such an office within the organizational structure of the Department of Defense.

(a) One possibility could be through the restoration of the position of Assistant Secretary of Defense (Health and Medical). This would serve a valuable purpose in bringing the operational problems of the medical service into direct contact with the research authorities and would facilitate the return flow of research data to the appropriate agencies.

The Assistant Secretary could have deputies--one for biomedical research, and one for personnel or administration. Then he would be able to supervise biomedical and clinical research programs and allocate personnel in the same office. However, much time would be consumed in seeking Congressional authorization of an additional Assistant Secretary of Defense. In view of the urgency of the situation, action to obtain this Congressional authorization would have to be started immediately.

(b) Possibly, the biomedical research program could be brought into the present structure of the Deputy Assistant Secretary for Defense (Health and Medical) in the Manpower office. This official's channels of communication now are through the Assistant Secretary of Defense (Manpower). For operating efficiency, he should have direct

communications with the Director of Defense Research and Engineering and with the Assistant Secretary of Defense for Civil Defense. Furthermore, he should communicate directly with the three Assistant Service Secretaries for R&D and with the three Surgeons General.

The Panel recognizes that, with the number of people involved, this proposal has obvious drawbacks.

(c) The most expeditious solution would be to appoint the Deputy Assistant Secretary for Manpower (Health and Medical) as the principal advisor for biomedical research to the Director of Defense Research and Engineering. Directives could be written by the Secretary of Defense establishing a formal coordination between the two.

2. Appointment of a departmental "Medical Biological Advisory Board," the chairman of which should be the highest ranking medical man in the Office of the Secretary of Defense. This Board would include:
   (a) A civilian representative from each of the three Assistant Secretaries for Research and Development.
   (b) A representative of the Joint Staff.
   (c) One officer, of some seniority, from each service who has demonstrated his ability to relate some field of technology to military developments.

(d) Six to eight outstanding civilian biological, medical, physical, and social scientists. These men must be competent to advise in the broad areas of particular interest to the military, such as now exist or may develop in relation to new plans or requirements.

This Advisory Board should meet at regular intervals and be authorized to call on the Surgeons General and other sources for information and should have the initial responsibility for:

(a) Identification of biomedical problems, where competence is needed, in the planning and decision-making structures of the Departments and the Services.

(b) Evaluation of the medical and biological programs of the three Services.

(c) Recommendation of optimal organization and programs for military biomedical research and development for all three Services.

(d) Additional panels of special consultants from civilian life and the three Services should be available for immediate call.

3. Establishment of contractor-managed, biomedical research facilities under the Office of The Secretary of Defense.

This would serve to overcome personnel and administrative difficulties implicit in the present pattern of operations.

4. Provision and maintenance of liaison with the Joint Chiefs of Staff through the Joint Staff, and with the individual Chiefs of Staff through the staffs of the individual Services.

Line officers of demonstrated capability should be assigned responsibility for identifying biomedical problems in the planning and weapons development area. To prepare these officers as thoroughly as possible, they should be assigned duties which would familiarize them with some phase of current research and development in biology and medicine. This could be done either inside or outside the military establishment.

An intensive program of evaluation of medical officers should be undertaken to identify those who would profit by attending Service schools, such as the war colleges. Every effort should be made also to introduce new course material into the curricula of the war colleges. Such course material should provide attendees with an appreciation and understanding of the present capabilities and limitations of manpower and of our medical resources. The student officers must be made completely aware of the existing facilities for maintaining needed manpower in the defense effort. In a recent classified report, reviewing their experiences in Kuwait, the British emphasized that one aspect of

their problem in this operation was their lack of this type of knowledge.

The experience of our forces in Lebanon and elsewhere--as well as the British experiences in Kuwait--can be attributed, in part, to failure to apply existing knowledge and exert proper command control. The importance of the human element in disease prevention cannot be minimized.